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# The Impact of Immigration on the Social Costs of the Ageing of the Population

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The findings of this paper are the sole responsibility of the authors and, as such, have not been endorsed by the Economic Council of Canada.

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## Foreword

The declining birth rate in Canada in recent years is cause for some concern. The latest data show that rate to be far below the replacement level. Such a low birth rate implies that, all other factors being equal, the population will stop growing at some point in the future and start declining. The proportion of the aged in the population will increase and the proportion of the young and middle-aged will decline in relative terms. As a result, the burden of the cost of education, health care, and social security will be borne by an increasingly smaller proportion of the population.

In order to slow down the ageing of the population, immigration is one possible substitute for natural increase in the host country. It enlarges the younger age group, thus broadening the base of taxpayers who carry most of the burden of the cost of social services.

In this paper, an attempt is made to calculate the effects of various levels of immigration on the cost structure of our social services. The authors estimate the age-and sex-specific per-capita expenditures for the provinces and for Canada. These base-year estimates are then used to calculate projected expenditures on social services, using the Economic Council of Canada's Demographic Projections Model.

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Judith Maxwell
Chairman

## Introduction

The decline in the fertility rate in Canada is cause for increasing concern. The latest figure puts it at 1.67 children per woman, far below the replacement rate of 2.1. So low a fertility rate implies that the population will stop growing at some point in the future and then start declining, all other factors being kept constant.

Whether population growth is desirable or not is subject to debate. Nevertheless, we can see that some effort is being made to raise the fertility rate. For example, in Québec, whose fertility rate of 1.4 is one of the lowest in the world, there is an incentive program to promote the birth of a third child, day-care facilities are being expanded, and so on. But the most important aspect of the declining fertility rate is not the decline in the population, but rather the change in the composition of that population. In particular, the problem that has more important consequences and is the main reason for our study is the *ageing of the population.* Our population is getting older and older, and the low fertility rate reinforces that trend.

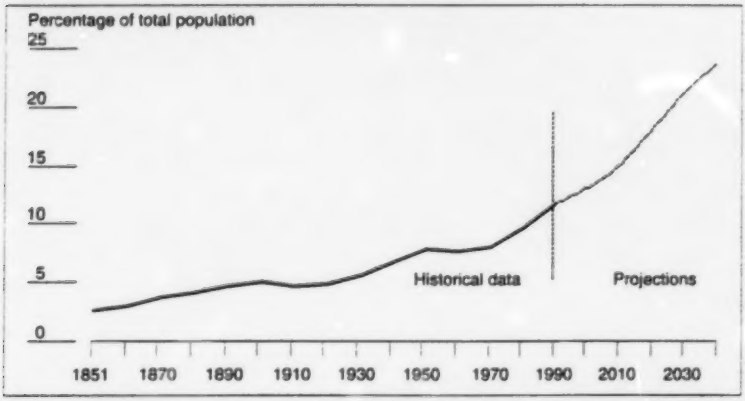
To convey the importance of the phenomenon, a graph showing the population aged 65 years and over as a proportion of the population is presented in Figure 1. The projections are based on net immigration at 0.4 per cent of the population (about 100,000 net immigrants in 1990), which corresponds roughly with the average for the past five years, and a constant fertility rate at the actual level. The proportion of elderly people is greater than it has ever been, and that is projected to double in the next 50 years. This increasing proportion of old people will create an enormous pressure on the existing social programs, as there are fewer people of working age to pay for health care and social security.

The main question that arises is: What will be the effect of the ageing of the population on social expenditures? We can expect these expenditures to go up, since the elderly are more intensive users of the health care system and certain social programs, such as Old Age Security pensions, apply only to them. How will the burden on taxpayers evolve? Since there will be proportionately fewer people of working age, we would expect their tax burden to go up. Can we quantify these factors? Is there a way to relieve the pressure on the social system?

The basic solution is to slow down the ageing of the population, and the most obvious way to achieve this is to increase the fertility rate. Traditionally, higher fertility has been promoted by means of subsidies to families. This method can be costly and causes ethical concerns. In addition, its efficiency is not proven; people may have reasons other than financial ones for not having more children.

**Figure 1**

**Population 65 and over as a percentage of total population, Canada, 1851-1989, and projections, 1990-2040**




Another possible way to slow down the ageing of the population is through immigration. This would work only if the immigrants were young, as has been the case in immigration to Canada in the past. Compared with the first method, immigration is much more manageable: as long as there are enough people who wish to immigrate to Canada, allowing in the desired number is straightforward. Immigration can provide a constant flow of young people and thus help to lower the age of the host population. This is not to say that immigration is free: the cost of administering the flow of immigrants and the provision of language training (among other things) ends up on the tax bill. The question is whether these extra costs are offset by savings in the cost of social services on taxpayers.

The goal of this paper is to try to calculate the effects of immigration on the tax burden represented by our social services. We computed sex- and age-specific per-capita costs for the major social expenditures in the base year[1], and projected them in the future using the Economic Council of Canada's Demographic Projection Model. These costs were calculated for the provinces and for Canada. We used four immigration scenarios: zero immigration; immigration at 0.4 per cent of the population; immigration at 0.8 per cent of the population; and the immigration proposal put forward in the Economic Council of Canada's 1991 statement on immigration. The Council's proposal recommends that the immigration level be set at the average of the last 25 years (0.63 per cent of the population) and that it then be gradually increased to reach 1 per cent of the population by 2015. Since our projection horizon goes to 2040, we kept immigration levels equal to 1 per cent of the population between 2015 and 2040 in that projection. By

comparing the cost projections associated with the different scenarios, we were able to compute the effect of immigration on the per-capita tax burden represented by the social services and determined which scenario, if any, is preferable.

Other studies have projected social expenditures using age-distributed data on costs. The best-known model of this kind is probably MEDS, which was developed by Denton et al. [1989], and which inspired us in our research. However, our approach is different from theirs in many respects. We project expenditures at the provincial level (which is, to our knowledge, a first); we include private expenditures wherever possible (namely health and education); and, whereas Denton et al. [1989] provide for fixed costs in their projections, we do not, because over a span of 50 years fixed costs make little sense.

## Data definitions and limitations

In this section we focus on three areas of public expenditures – health care, education, and social security. In dollar amounts, these categories are very large; they also vary with the age distribution of the population.

The outlays on social security, which amounted to over $35 billion in 1985, are primarily financed by the federal government. They account for roughly two thirds of total expenditure; the remaining one third comes from provincial and local governments. Health care programs and education, on the other hand, are the responsibility of provincial governments.

Published information on age- and sex-specific public expenditures is hard to come by. The available data do not, by and large, harmonize with our requirements, because in most instances they are given for a few larger aggregates that group together a number of age groups.

We analyze here the total cost and the costs to each province of promoting health care, financing education, and providing social services. We attempted to obtain all the information that would enable us to estimate the age- and sex-specific expenditures for each province on these categories.[2]

We adopted a five-year interval for the age groups; the 0-4 age group up to the 85 and over age group — a total of 18 groups. The age- and sex-specific data are generally only available for a few aggregated age groups. This was the case with Statistics Canada's data, where the age- and sex-specific hospital expenditure data were available for only eight age groupings. Consequently, when we estimated the expenditure per person of a larger aggregate, for example, the 25-44 age group, for which the basic data were available, we assigned the same dollar amount to each of the five-year subsets of this age group.

## Health care

At the aggregate level, the data on Canada's total health care expenditures are available from Health and Welfare Canada, the Health Division of Statistics Canada, and Statistic Canada's Consolidated Government Expenditures publications. We chose to use Health and Welfare Canada's data base, because it has a more comprehensive coverage. We considered only the categories that account for the major part of public expenditure: hospitals, physicians, and special care facilities. These three account for 90 per cent of total public spending.

*Hospital expenditures* — To determine the hospital expenditures by age, sex, and province, we used Statistics Canada's estimates of projected expenditure on hospital care for the year 1986.[3] These projected values were available by province, by sex, and disaggregated into eight age groups.

*Residential care facilities* — Among the facilities included are homes for the aged, physically handicapped, psychiatrically disabled, for people with alcohol and drug problems, for emotionally disturbed children, for transients, and for delinquents, and shelters for families in crisis.[4]

For the per-capita cost of residential care facilities we used Statistics Canada's data on the number of residents in residential care facilities that reported from each province and the territories.[5] The institutions in all provinces except Quebec responded to the questionnaire sent out by Statistics Canada.[6] Quebec conducts its own survey; their methodology and classifications are different from those of other provinces. Quebec does, however, provide data on the total number of residents male and female — as well as some incomplete details for a few age groups. There is no breakdown by age group over 69 years of age. The total number of residents in Quebec, however, is included in the Canada aggregate. In order to align the data on Quebec residents of residential care institutions with other provinces' age and sex breakdown, we calculated appropriate age specific estimates for Quebec males and females. We assumed that Quebec and Ontario have a similar age distribution in residential care institutions and used Ontario's distribution of age groups as proxy for Quebec. We applied it to the Quebec total that is published by Statistics Canada.

In all provinces except Newfoundland, Prince Edward Island, Manitoba, and British Columbia, the sum total of all age groups does not exhaust the total number of residents,[7] because not all the reporting institutions provided age-specific data. We assumed that the age distribution of residents in most institutions would be much the same, and that the pattern of age groupings in those institutions that did not supply a detailed age breakdown would closely resemble the age distribution patterns of the institutions that

did. For the provinces that provided incomplete information, we calculated the difference between the sum total of all nine age groups and the reported total number of residents, and redistributed this difference (or residual) to each age group according to its weight. This provided us with the number of residents by age group and gender with which we calculated the age- and sex-specific per-capita cost of residential care facilities.

*Physicians* — Data on public expenditure on physicians are available for Nova Scotia, Quebec, Saskatchewan, Alberta, and British Columbia and are reasonably detailed.[8] For these provinces we have the number of beneficiaries and the amounts payed out to physicians on behalf of the patients for male and female patients and disaggregated into various age groups. Using this information and census population data we estimated the per-capita expenditure on physicians and stratified them into six major age/sex groups for each of these provinces.

In the absence of any age- and sex-specific data on the cost of physicians to other provinces (i.e., Newfoundland, Prince Edward Island, New Brunswick, Ontario, and Manitoba) we decided, faute de mieux, to estimate the population-weighted average per-capita expenditure on physicians in the five provinces for which we had detailed data, and to use it as proxy for each of the provinces for which no detailed information was available and for Canada.

Since most of the age groups for which we had expenditure data on physicians contain two or more five-year groups, here too we assigned to each five-year subset the same per-capita expenditure.

### *Education*

The costs of education are not insignificant. In 1985-86, total spending on education represented 7.2 per cent of Canada's gross domestic product, amounting to almost 35 billion dollars.

For the purposes of our analysis of public expenditure on education we considered three major levels: elementary and secondary, community colleges, and university (full-time and part-time). Elementary and secondary education accounted for roughly two thirds of the total, university education accounted for one fifth, and the remainder was accounted for by college– and trade–level programs.[9]

### *Social security*

We dealt primarily with the five largest items of expenditure on social security ranked by the dollar amount of expenditure in 1985. These were as

follows: old age security pensions — $12.5 billion; unemployment insurance — $10.5 billion; other pensions and superannuation — $7.8 billion; Canada and Quebec pension plans — $7.0 billion; and family allowance — $2.7 billion. We used Revenue Canada taxation statistics for detailed data by province, age, and sex. These data reflect incomes as declared in income tax returns. They do not, however, tally with the amounts that governments spend on each of these individual programs. The difference between the aggregate receipts, or incomes, and the government outlays is, in part, due to the fact that a number of beneficiaries of social security programs do not file income tax returns. Furthermore, some people underreport real income or benefits received from these sources. In the case of old age security pension the taxation data does not include the Guaranteed Income security or the Spouse Allowance, which in 1985 represented more than a quarter of the total expenditure on old age pensions. However, the taxation statistics did provide us with the detailed income information by selected age groups for Canada as well as the totals by category of income for each province that we required for our model.

The age- and sex-specific estimates of public expenditure on social security adjusted so that they were in harmony with the total expenditure on social security programs as reported in the consolidated government expenditure accounts. The estimating procedures for each social security program differ slightly because of differences in the data. For the three kinds of income security, namely the old age security pension, the Canada and Quebec pension plans, and family allowance the procedure is the same.

The resulting per-capita costs by sex and by age group for Canada are presented in Tables 1 to 3. The family allowance figures might seem surprising because the costs are imputed not to the young but to the parents. This is because the distribution comes from taxation statistics, and it is the parents who file family allowances in their returns. This could cause a problem in the projections if the fertility rates were evolving; this is not the case here. Since the fertility rates are fixed for each province in our projections, it does not matter whether the costs are imputed to the children or the parents.

**Table 1**

**Per capita expenditures on health, by gender and age, 1985**

| | | Hospitals | Physicians | Special care | Total health |
|---|---|---|---|---|---|
| | Age | | (Dollars) | | |
| Males | 0–4 | 1459.03 | 242.94 | 10.90 | 2580.66 |
| | 5–9 | 148.98 | 140.65 | 10.90 | 452.78 |
| | 10–14 | 148.98 | 126.74 | 67.19 | 516.64 |
| | 15–19 | 217.32 | 122.68 | 67.19 | 613.49 |
| | 20–24 | 217.32 | 124.75 | 79.90 | 635.75 |
| | 25–29 | 257.26 | 148.40 | 79.90 | 731.57 |
| | 30–34 | 257.26 | 155.35 | 79.90 | 742.05 |
| | 35–39 | 257.26 | 155.45 | 79.90 | 742.18 |
| | 40–44 | 257.26 | 164.71 | 79.90 | 756.13 |
| | 45–49 | 742.17 | 255.49 | 92.39 | 1642.32 |
| | 50–54 | 742.17 | 277.30 | 92.39 | 1675.17 |
| | 55–59 | 742.17 | 277.11 | 92.39 | 1674.88 |
| | 60–64 | 742.17 | 321.07 | 92.39 | 1741.12 |
| | 65–69 | 1778.41 | 479.39 | 222.20 | 3736.45 |
| | 70–74 | 1778.41 | 549.75 | 372.22 | 4068.49 |
| | 75–79 | 3897.30 | 548.40 | 753.58 | 7833.40 |
| | 80–84 | 3897.30 | 549.35 | 1778.71 | 9379.34 |
| | 85 + | 3897.30 | 547.50 | 4588.68 | 13610.14 |
| Females | 0–4 | 1319.26 | 210.89 | 5.34 | 2313.41 |
| | 5–9 | 117.68 | 131.32 | 5.34 | 383.18 |
| | 10–14 | 117.68 | 132.08 | 45.25 | 444.46 |
| | 15–19 | 179.04 | 227.49 | 45.25 | 680.65 |
| | 20–24 | 179.04 | 270.74 | 49.27 | 751.89 |
| | 25–29 | 348.25 | 313.08 | 49.27 | 1070.62 |
| | 30–34 | 348.25 | 311.17 | 49.27 | 1067.74 |
| | 35–39 | 348.25 | 310.68 | 49.27 | 1067.01 |
| | 40–44 | 348.25 | 302.70 | 49.27 | 1054.98 |
| | 45–49 | 699.36 | 323.87 | 62.00 | 1635.04 |
| | 50–54 | 699.36 | 330.03 | 62.00 | 1644.32 |
| | 55–59 | 699.36 | 330.13 | 62.00 | 1644.46 |
| | 60–64 | 699.36 | 347.36 | 62.00 | 1670.43 |
| | 65–69 | 1512.85 | 442.25 | 187.58 | 3228.22 |
| | 70–74 | 1512.85 | 487.47 | 415.30 | 3639.44 |
| | 75–79 | 3708.05 | 484.98 | 1030.00 | 7869.21 |
| | 80–84 | 3708.05 | 485.00 | 2706.48 | 10395.06 |
| | 85 + | 3708.05 | 490.26 | 6816.81 | 16595.76 |

Source Various publications; Health and Welfare Canada, Statistics Canada, *National Health Expenditures in Canada, 1975–1987*, and estimates by the authors.

**Table 2**

**Per capita expenditures on education, by gender and age, 1985**

| | | Elementary & secondary | Community college | University | Total education |
|---|---|---|---|---|---|
| | Age | | (Dollars) | | |
| Males | 0–4 | — | — | — | — |
| | 5–9 | 4778.88 | — | — | 5202.2 |
| | 10–14 | 4438.87 | — | — | 4832.1 |
| | 15–19 | 2716.65 | 436.04 | 690.66 | 4183.8 |
| | 20–24 | 54.19 | 620.94 | 1520.3 | 2390. |
| | 25–29 | — | 88.36 | 521.44 | 663.82 |
| | 30–34 | — | 35.28 | 253.28 | 314.12 |
| | 35–39 | — | 21.98 | 130.79 | 166.3 |
| | 40–44 | — | 9.24 | 58.62 | 73.87 |
| | 45–49 | — | — | 58.62 | 63.81 |
| | 50–54 | — | — | — | — |
| | 55–59 | — | — | — | — |
| | 60–64 | — | — | — | — |
| | 65–69 | — | — | — | — |
| | 70–74 | — | — | — | — |
| | 75–79 | — | — | — | — |
| | 80–84 | — | — | — | — |
| | 85 + | — | — | — | — |
| Females | 0–4 | — | — | — | — |
| | 5–9 | 4789.14 | — | — | 5213.4 |
| | 10–14 | 4444.61 | — | — | 4838.4 |
| | 15–19 | 2554.39 | 633.55 | 795.3 | 4336.1 |
| | 20–24 | 73.86 | 540.03 | 1448.3 | 2244.9 |
| | 25–29 | — | 87.76 | 393.26 | 523.64 |
| | 30–34 | — | 50.56 | 230.09 | 305.52 |
| | 35–39 | — | 50.41 | 182.85 | 253.92 |
| | 40–44 | — | 21.43 | 110.67 | 143.8 |
| | 45–49 | — | — | 110.67 | 120.47 |
| | 50–54 | — | — | — | — |
| | 55–59 | — | — | — | — |
| | 60–64 | — | — | — | — |
| | 65–69 | — | — | — | — |
| | 70–74 | — | — | — | — |
| | 75–79 | — | — | — | — |
| | 80–84 | — | — | — | — |
| | 85 + | — | — | — | — |

Source Statistics Canada, various publications; and estimates by the authors.

**Table 3**

**Per capita expenditures on social services, by gender and age, 1985**

| | | Family allowance | Unemployment insurance | Old age security | CPP & QPP[1] | Other pensions | Total income | Taxes payable |
|---|---|---|---|---|---|---|---|---|
| | Age | | | | (Dollars) | | | |
| Males | 0–4 | 0.15 | — | — | 2.10 | 0.51 | 537.55 | — |
| | 5–9 | 0.15 | — | — | 2.10 | 0.51 | 537.55 | — |
| | 10–14 | 0.15 | — | — | 2.10 | 0.51 | 537.55 | — |
| | 15–19 | 0.15 | 118.39 | — | 2.10 | 0.51 | 537.55 | 122.30 |
| | 20–24 | 24.62 | 980.71 | — | 13.76 | 1.65 | 11027.33 | 1544.09 |
| | 25–29 | 156.62 | 1099.31 | — | 5.73 | 3.56 | 20136.32 | 3739.61 |
| | 30–34 | 372.24 | 894.32 | — | 13.88 | 2.39 | 25415.97 | 5125.54 |
| | 35–39 | 521.20 | 739.17 | — | 23.67 | 12.65 | 29466.63 | 6341.15 |
| | 40–44 | 538.84 | 649.34 | — | 36.38 | 40.77 | 32058.34 | 7067.21 |
| | 45–49 | 353.45 | 649.26 | — | 80.39 | 129.49 | 31901.74 | 7158.15 |
| | 50–54 | 176.38 | 684.99 | — | 131.72 | 305.19 | 30643.88 | 5118.36 |
| | 55–59 | 85.12 | 819.76 | — | 290.64 | 1094.18 | 29952.95 | 6491.24 |
| | 60–64 | 34.22 | 824.92 | — | 869.87 | 2847.57 | 24776.52 | 5024.27 |
| | 65–69 | 9.63 | 193.53 | 6307.45 | 4067.56 | 3931.89 | 20552.47 | 3076.83 |
| | 70–74 | 3.88 | 0.10 | 6337.46 | 3514.99 | 3050.17 | 16193.00 | 2404.27 |
| | 75–79 | 1.28 | 0.23 | 5261.02 | 1581.84 | 1973.25 | 12264.81 | 1775.25 |
| | 80–84 | 1.28 | 0.23 | 5261.02 | 1581.84 | 1973.25 | 12264.81 | 1775.25 |
| | 85 + | 1.28 | 0.23 | 5261.02 | 1581.84 | 1973.25 | 12264.81 | 1775.25 |

**Table 3 (cont'd.)**

| | | Family allowance | Unemployment insurance | Old age security | CPP & QPP[1] | Other pensions | Total income | Taxes payable |
|---|---|---|---|---|---|---|---|---|
| | Age | | | | (Dollars) | | | |
| Females | 0–4 | 1.48 | — | — | 2.10 | 0.28 | 372.00 | — |
| | 5–9 | 1.48 | — | — | 2.10 | 0.28 | 372.00 | — |
| | 10–14 | 1.48 | — | — | 2.10 | 0.28 | 372.00 | — |
| | 15–19 | 1.48 | 44.23 | — | 2.10 | 0.28 | 372.00 | 49.44 |
| | 20–24 | 39.60 | 538.87 | — | 14.51 | 1.00 | 7971.40 | 889.21 |
| | 25–29 | 99.87 | 830.51 | — | 8.77 | 2.27 | 11678.28 | 1726.70 |
| | 30–34 | 155.30 | 654.23 | — | 29.14 | 3.83 | 12272.22 | 1896.08 |
| | 35–39 | 195.82 | 506.64 | — | 44.30 | 8.49 | 13133.97 | 2063.43 |
| | 40–44 | 160.39 | 412.00 | — | 84.01 | 13.89 | 13364.57 | 2117.15 |
| | 45–49 | 87.27 | 408.22 | — | 148.52 | 36.82 | 12935.48 | 2060.32 |
| | 50–54 | 41.26 | 320.07 | — | 252.65 | 89.28 | 11394.51 | 1818.84 |
| | 55–59 | 16.66 | 316.03 | — | 444.95 | 303.78 | 10155.87 | 1550.48 |
| | 60–64 | 4.61 | 239.86 | — | 716.33 | 664.65 | 8775.73 | 1313.97 |
| | 65–69 | 2.12 | 44.75 | 3969.44 | 1569.19 | 975.31 | 8822.64 | 1014.80 |
| | 70–74 | 0.70 | 0.10 | 4089.26 | 1304.45 | 950.54 | 8263.21 | 1043.33 |
| | 75–79 | 1.05 | — | 3788.95 | 543.93 | 750.52 | 7411.26 | 882.42 |
| | 80–84 | 1.05 | — | 3788.95 | 543.93 | 750.52 | 7411.26 | 882.42 |
| | 85 + | 1.05 | — | 3788.95 | 543.93 | 750.52 | 7411.26 | 882.42 |

[1]Canada and Quebec pension plans.

Source Revenue Canada, *Taxation Statistics (1985)*; Statistics Canada, *Consolidated Government Expenditures (1985)*; estimates by the authors.

## Methodology

### *Demographic model*

The population projections for this study had to be very detailed: they had to include the population by province, by sex and by five-year age group. Furthermore, the model generating these projections had to be flexible enough to enable us to make changes in our basic assumptions. Statistics Canada's published projections are not based on the same assumptions that we use, and the MEDS model [Denton et al., 1989] does not work at the provincial level.

Fortunately, the Council has a model, the Demographic Projection Model (DPM), developed by Haider Saiyed [1988]. This model is very flexible in that the basic assumptions of the model can be modified fairly easily, and the projections are made by province, sex, and age group.

The fertility rate for Canada in 1986 was 1.67 births per woman [Statistics Canada (date?)]. Provincial figures were also used in the projections. These rates were kept constant for all scenarios over the projection period, except in one simulation where it was raised to the replacement rate of 2.1 to compare the effects of higher birth rates with those of higher immigration.

The death rates are also province-specific, and are based on recent trends. In the DPM death rates are used instead of the preferred life tables method, so we adjusted the death rates in order to make the number of deaths consistent with life tables.[10]

The number of immigrants in our projections is a proportion of the population. Unfortunately, the DPM cannot produce those numbers automatically; instead, we used MEDS (which enables us to project immigration as a percentage of the population) for the projections for Canada. This produced the number of immigrants corresponding to each scenario, which were then included in the DPM and distributed to the provinces according to their observed share of Canadian immigration.

Interprovincial migration is the most volatile aspect of population movement in Canada. Ten years ago people were coming by the truckload to Alberta from other parts of the country; five years later the pattern was reversed. Interprovincial migration seems to be driven partly by economic conditions, and partly by the political conditions (for example, the Anglophone exodus from Quebec fifteen years ago). These two factors do not explain all the movements in interprovincial migration. Because population movements cannot be forecast, one has to choose a plausible scenario. For

this study, we chose the observed net interprovincial migration in each province for the past ten years and repeat these figures into the future. This calculation produces net gains in provincial migration for Ontario, Alberta and British Columbia, and losses (to various degrees) for the other provinces.

The projections based on those assumptions (no net immigration, immigration at 0.4 per cent and 0.8 per cent of the population, and the Council's 1992 proposal) are very solid, as they are remarkably close to those of MEDS and Statistics Canada (when equivalent scenarios are available), both in terms of the provincial (where applicable) and age/sex distribution of the population.

***Expenditure projection framework***

To evaluate the burden of dependency, demographers traditionally use a measure called a "dependency ratio," which compares the number of young and elderly people with the number of working-age people. The rationale behind this measure is that both ends of the population pyramid contribute to the dependency burden, the young mainly through education costs and the elderly through health care and pensions. The dependency ratio thus measures the number of dependents "carried" by each working-age person.

The main problem with this measure is that it does not distinguish between the young and the elderly as long as the two groups taken together keep the same share of the population, the dependency ratio remains constant, even if the share of each group changes. This would be of no consequence if expenditures on the young and on the elderly were the same; however, research shows that expenditures on the elderly far surpass those on the young. Since we expect the population to age substantially in the future, using the dependency ratio would give us downward-biased estimates of the dependency burden. It is thus preferable to measure changes in the tax burden that are caused by changes in the age structure of the population and by immigration.

We concentrated our efforts on health, education, and social security because of their importance and because expenditures on them vary substantially with the age of the beneficiary; i.e., education expenditures are mainly on school-age children, health care expenditures are principally on the elderly (and very young children, to a lesser degree), and a large proportion of expenditures on social security are on the elderly and the young.

First, we computed the age- and sex-specific per-capita expenditures for Canada and each province for expenditure category. Eighteen age cate-

gories were computed for each sex, going from 0-4 years in five-year increments to 85 years and older. Next, we integrated the population projections we created using the Council's Demographic Projection Model (DPM) for each of the four immigration scenarios studied. These gave us detailed projections by province, sex, and age group up to the year 2040. By combining the age- and sex-distributed expenditure data with the population projections, we can project the total expenditures for each category. This permits us to compute the per-capita savings of going from one immigration scenario to another.

Next, we adjusted for the fact that the tax revenues also depend on the age structure of the population; we thus projected the income tax payable (federal and provincial) in the same way as we did for the expenditures, and adjusted the previous savings by the change in per-capita tax receipts.

It is also necessary to adjust for immigration costs, such as language training, welfare assistance, and administration of the flow of immigrants. In 1985, these costs amounted to $432 million. Since each scenario we study has different immigration levels, the costs vary accordingly. Therefore they have to be projected according to the immigration level and then subtracted from any gain from higher immigration in order to give us the net savings from higher immigration.

Projecting expenditures by age group also enables us to compute an expenditure "equivalent" to the numerical dependency ratio and other indicators, which we will describe in the next section.

## Detailed calculations

Define $EXP_{jt}$ as expenditures on category j at time t, $POP_{tsi}$ as the population at time t for sex s and age group i, and $EXP_{jbsi}$ as the per-capita expenditure on category j, sex s, and age group i for the base year b, then expenditures on a given category, in constant dollars of the base year can be calculated with the following formula:

$$EXP_{jt} = \sum_{s} \sum_{i} POP_{tsi} * EXP_{jbsi} \quad (1)$$

This method could not be used to calculate expenditures on immigration and settlement programs, because these expenditures are directly related to the levels of immigration and not to the age distribution. Instead, we computed the per-immigrant expenditure for the base year and multiplied it by the projected levels of immigration to get the projected expenditures on immigration.

With the projections on social expenditures, tax receipts, and immigration costs, we were able to measure the extent to which immigration can relieve the burden of the expected increase in social costs by comparing projections with different immigration scenarios. This gave us the projected savings (if any) of higher immigration. These projections rely implicitly on the following assumptions:

*Per-capita expenditures are fixed* — Both the distribution and the level of expenditures in each projected category are frozen at their base-year levels. The method does not permit the cost structure to evolve, because allowing for evolution in the cost structure would require much more data and would be more complicated (we intend to tackle those problems in a future paper).

*The base year used is 1985* – Sincewe used fixed coefficients, the choice of the base year was important in recessions than in expansions. However, we were constrained by the limits of the data. We choses the year 1985 because data is available for that year for most of the expenditure categories we wanted to project. Furthermore, 1985 was neither a peak or a trough in theeconomic cycle, and thus should not be biased toward a certain type of expenditure.

*The immigrant distribution is fixed* — We take for granted here that the age distribution of immigrants is fixed at the levels of the last few years, and that the distribution of immigrant categories does not change; i.e., the proportions of refugees, family class immigrants and independent immigrants stays the same. Although the general composition of immigration has changed, predicting what it will be in the future is as feasible as trying to predict stock market movements.

*Immigrants are considered as being clones of the Canadian population* — This is an important assumption, as it presumes that immigrants use the social system at exactly the same rate as Canadians in a given sex and age group do, and that they earn the same and pay the same taxes. There is some evidence that, all other things being equal, immigrants earn less than Canadians when they arrive in Canada, but these differences vanish with time. On the expenditures side, we have no information about the level at which immigrants use the system compared with the native-born population.

*Expenditures on immigrants are incurred in the year of arrival* — We do not know how long immigrants receive assistance from the government; the base-year expenditure data we have is probably split between support for newly-arrived immigrants and continuing support for previous immigration. Since we have no indication of the distribution of these

expenditures, we arbitrarily applied them to immigrants in the year of arrival, keeping in mind that our expenditure estimates will be slightly biased upward if immigration levels go up constantly.

Since our projections used age-distributed data, it gave us the flexibility to project expenditures and taxes for specific age groups. We could therefore compute the expenditure version of the dependency ratio, the expenditure dependency ratio (EDR), which is computed as the sum of the expenditures borne by the young and the elderly divided by the taxes payable by the working-age group. The formula can be expressed as follows:

$$EDR_t = \frac{\sum_j \sum_s \sum_{i \in Y+O} POP_{tsi} * EXP_{jbsi}}{\sum_s \sum_{i \in W} POP_{tsi} * TAX_{bsi}} \qquad (2)$$

where $POP_{tsi}$ and $EXP_{jbsi}$ are as defined in equation (1), $TAX_{bsi}$ represents the per-capita taxes payable (federal and provincial in our case) in base year b for sex s and age group i, and Y+O and W under the summation signs stand for the young and the elderly (0-19 years and 65 years and over) and for the working-age group (20-64 years) respectively. The EDR gives us a more precise measure of the dependency burden because it takes into account the age distribution of expenditures and taxes. It is worth noting that expenditures on immigration-program and settlement expenses are not included in this ratio, because the majority of immigrants are young adults, expenditures on whom should not go into the computation of that ratio.

The EDR is a good indication of future expenditure dependency, but we also wanted a "dollars and cents" measure of the potential savings brought by immigration. If we double immigration over the whole projection period, there will be extra costs for those immigrants. On the other hand, if the higher population resulting from higher immigration generates savings in per-capita expenditures on social programs, will these savings offset the extra immigration costs?

We can expect the balance to be negative in the first projection years, because while the immigrant costs are being incurred in the present, the potential benefits will not be visible until there is a substantial difference in population composition between the low and the high immigration scenario. It is possible that after some time the benefits will overcome the extra costs, and it is also possible that they will not. We thus define the immigrant gain ($IG_T$) as the sum of the discounted values of the savings in per-capita expenditures brought by higher immigration minus the extra per-capita immigration costs, for each projected year, until time T. The formula is expressed as follows:

$$IG_T = \sum_{t=1990}^{T} (1 + i)^{t-1990} \left[ \sum_j \left( \frac{EXP_{jt}^L}{POP_t^L} - \frac{EXP_{jt}^H}{POP_t^H} \right) + \left( \frac{TAX_{jt}^H}{POP_t^H} - \frac{TAX_{jt}^L}{POP_t^L} \right) - \left( \frac{IMM_t^H}{POP_t^H} - \frac{IMM_t^L}{POP_t^L} \right) \right], \quad (3)$$

$$T = 1990, \ldots 2040.$$

where $EXP_{jt}$ the same as in equation (1), $POP_t$ is the total population at time t, $TAX_t$ is the taxes payable, $IMM_t$ is the total immigrant expenditures projected for the year t, i is the real interest rate, and H and L are high or low immigration. This is the calculation of the savings that result from higher immigration. This value will be highly dependent on the discount rate used (which is assumed constant for our purpose); we use a real discount rate of 5 per cent.

## Results of projections

### *Overview*

To summarize results of our projections, immigration helps to alleviate the tax burden represented by the ageing population, but it does not solve the problem unless we revert to extreme, unrealistic scenarios. Some substantial savings would result from higher immigration (Table 4), but while the best scenario shows $590 dollars in savings per capita over the base case, expenditures on social programs would still rise by over $1,100 for every Canadian — $748 for health care and $616 for social security. Per-capita education expenditures would decrease by $264. Note, however, that these figures represent the effect of changing the age distribution; the actual increases are expected to be much larger, mainly because of rising health costs.

**Table 4**

**Projected per capita savings from the 0.8 per cent and Council immigration scenarios compared with the 0.4 per cent immigration scenario, Canada, selected years**

| | Year | Expenditures | Taxes | Immigration costs | Total | Population (millions) |
|---|---|---|---|---|---|---|
| | | | (1985 dollars) | | | |
| Immigration at 0.8% of population | 2015 | 165.91 | −7.99 | −19.80 | 138.12 | 35.4 |
| | 2040 | 583.59 | 24.44 | −19.83 | 588.20 | 42.9 |
| Economic Council proposal | 2015 | 106.42 | −9.75 | −22.50 | 74.17 | 34.1 |
| | 2040 | 545.00 | 18.67 | −22.19 | 541.48 | 41.9 |

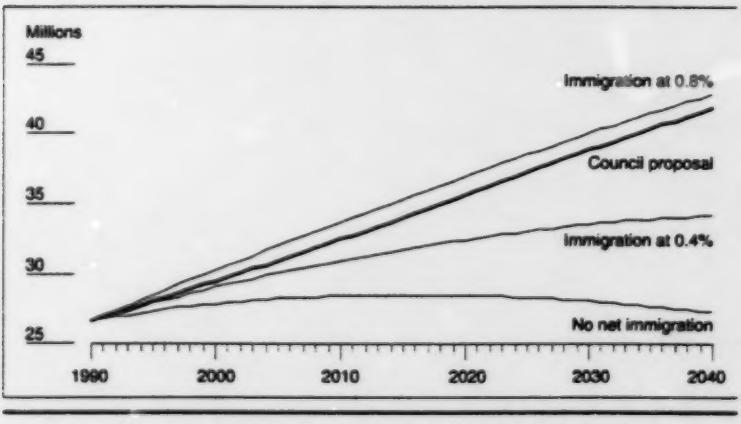
Detailed results for the provinces will not be reported in this section in the interest of brevity; they are available on request. In general, according to the projections, provinces in which immigration is important (Ontario and British Columbia, primarily) would gain the most from higher immigration, whereas provinces where it is less important, such as the Maritime provinces, would gain very little. This is because in our population projections immigration is distributed according to recent trends, as is interprovincial migration, which reinforces that trend.

***Detail***

Immigration has a strong impact on population, as can be seen in Figure 2. The difference in population between the scenario of no further net immigration and that in which immigration is held at 0.8 per cent of population (net) is in the order of 60 per cent, which is quite substantial. Under the no net immigration scenario, Canada's population reaches a peak at 28.5 million people in 2016 and then declines to a level of 27.2 million in 2040. Under the other three scenarios, the population keeps growing to maximums of 34.2, 42.9, and 41.8 million for the 0.4 per cent and 0.8 per cent projections and the Council's 1992 proposal, respectively.

**Figure 2**

**Projected population under four immigration senarios, 1990-2040**



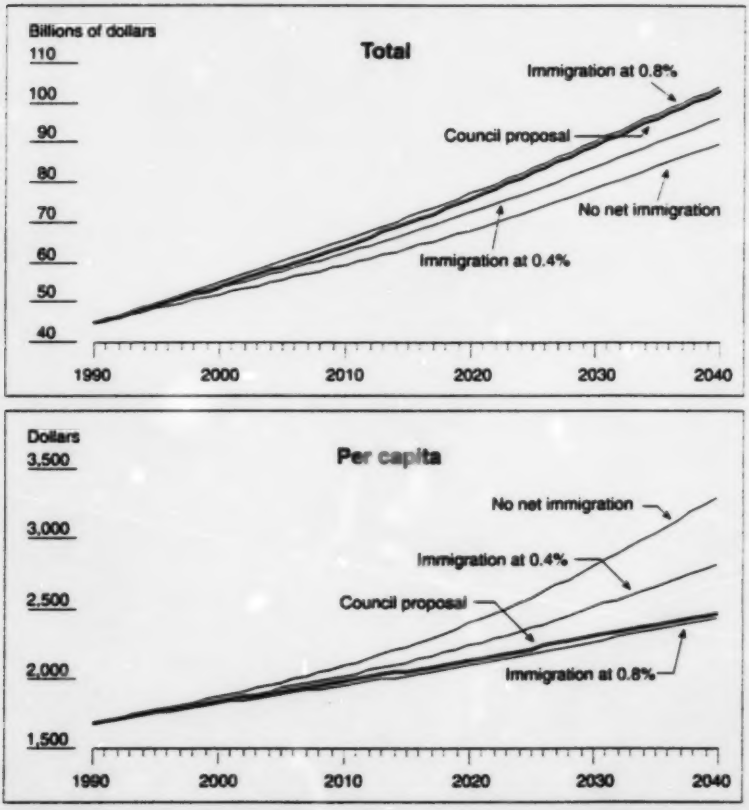

The expenditure projections do not evolve in the way that the underlying population projections might suggest. We will examine here each broad expenditure category to show the effects of immigration.

## Health

The effect of the changing age distribution on health expenditures is strong in all scenarios, especially after 2015 when the baby-boomers start to retire (Figure 3).

**Figure 3**

**Projected total and per-capita health expenditures under four immigration scenarios, 1990-2040**




In all cases, the expenditures on health more than double; what is more interesting is that the per-capita expenditures rise sharply. In the worst case (the no net immigration scenario) they approximately double, and in the most favourable scenario (the 0.8 per cent immigration scenario) they go up by 50 per cent.

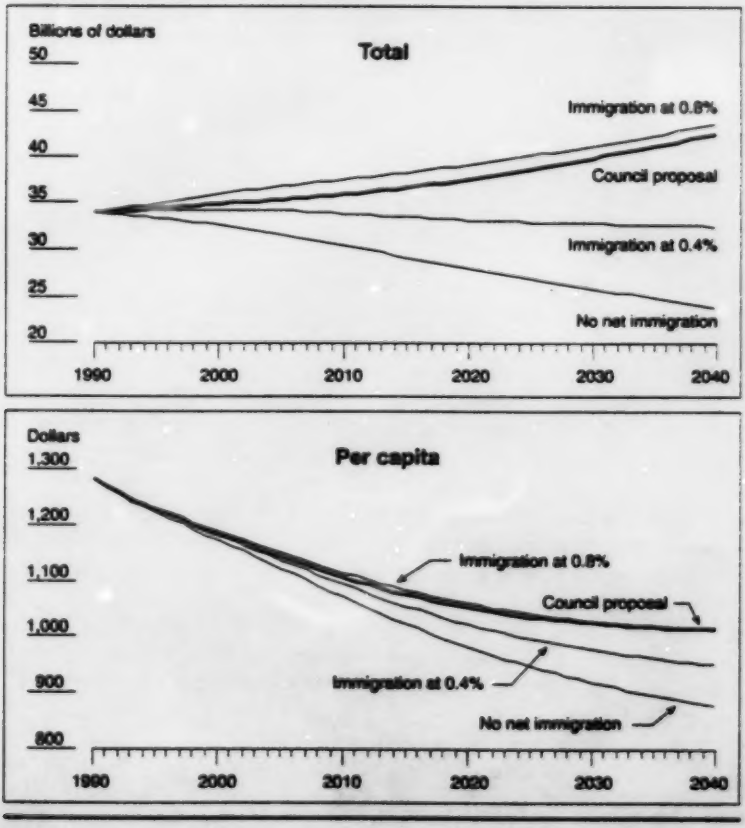
## *Education*

Immigrants come into the country at a young age, on average. We would therefore expect them to have more children than the native-born population, even if both groups had the same fertility rate. This implies that more immigration would increase education costs, offsetting some of the savings on health care.

This is indeed the case: total expenditures go down if we cut immigration (by 30 per cent in the no immigration case), and go up if we adopt the higher immigration scenarios (by 28 per cent in the 0.8 per cent immigration scenario, and by 25 per cent for the Council proposal) (Figure 4). But we also see that per-capita expenditures go down regardless of which scenario we pick; the highest immigration scenarios post the lowest decreases.

**Figure 4**

**Projected total and per-capita education expenditures under four immigration scenarios, 1990-2040**



Education and health expenditures thus go in opposite directions — per-capita health costs go up no matter what, whereas per-capita education expenditures go down in all scenarios. But the savings on education will not cancel out the higher costs on health care.

### *Social security*

It is difficult to predict how expenditures on social security will evolve, as the categories included in our projections are expected to move in opposite directions: family allowance costs should go down, it is unclear how unemployment insurance will react, and pensions are expected to go way up.

The projections indicate that social security costs will climb considerably, with increases ranging from 76 per cent in the no net immigration case to 121 per cent in the high immigration scenario (Figure 5). As far as per-capita costs are concerned, the highest increase, at 71 per cent, is shown by the no net immigration scenario, compared with 37 per cent for the 0.8 per cent immigration scenario. Again, higher immigration helps to slow the increase in per-capita costs, but costs still increase as a result of changes in the age distribution.

### *Total expenditures*

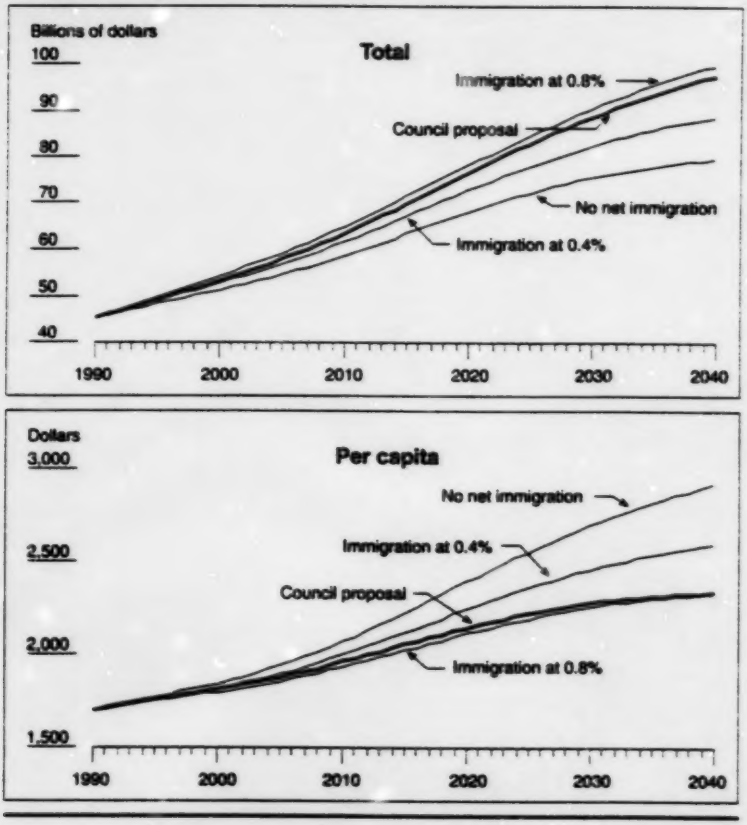
It is now time to sum up all those categories projected so far to see the effect of higher immigration on per-capita expenditures.

Changes in the age distribution of the population cause total expenditures (on health, education, and social security) to go from $124 billion (1985 dollars) in 1990 to $193 billion in 2040 under the no net immigration scenario, to $217 billion under the 0.4 per cent immigration scenario, to $247 billion under the 0.8 per cent immigration scenario, and to $243 billion under the Council's proposal (Figure 6). In all cases the per-capita costs go up considerably: the lowest increase is 24 percent for the 0.8 per cent immigration scenario, and the highest increase is a massive 52 per cent for the no net immigration scenario.

Remember that these figures only take into account the ageing of the population. If the unit costs that have been kept constant in this projection exercise rise (as is the case for health care), those projections will underestimate the real figures.

**Figure 5**

**Projected total and per-capita social security expenditures under four immigration scenarios, 1990-2040**



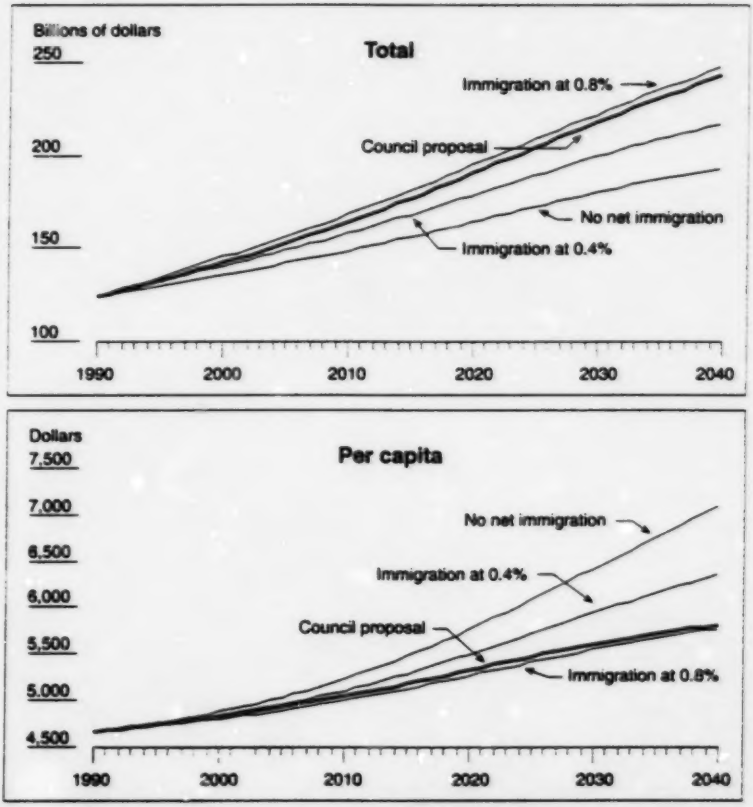

***Expenditure dependency ratios***

The results presented so far do not take into account the possible shrinking of the tax base brought about by a shift in the age pyramid away from the working-age population groups, who earn more money and thus pay more taxes. In other words, the per-capita costs rise more slowly than the costs per worker, and it is the workers who will bear the increased burden of social expenditures. We therefore computed the expenditure dependency ratios (EDR) to take this factor into account.

We computed the EDRs for the four scenarios using equation (2). We can see that the cost increase will not be very large for the next 25 years. But then they rise at a frantic pace. The ratio will more than double over the projection

**Figure 6**

**Projected total expenditures under four immigration scenarios, 1990-2040**




period in the no immigration scenario (207 per cent), by 68 per cent in the 0.4 per cent immigration case, by 40 per cent in the 0.8 per cent immigration projection, and by 42 per cent in the Council's proposal (Figure 7). Remember that there was a 52 per cent increase in per-capita costs in the no immigration scenario, and a 24 per cent rise in the 0.8 per cent scenario (see Figure 6). The EDR thus highlights the shrinking tax base effect.

### *Immigrant expenditures*

The decreases in per-capita costs have to be reduced by the costs of bringing in the extra immigrants in order to complete the picture. Expenditures on immigration (social assistance for refugees, language training, and

**Figure 7**

**Projected expenditure dependency ratios for four immigration scenarios, 1990-2040**

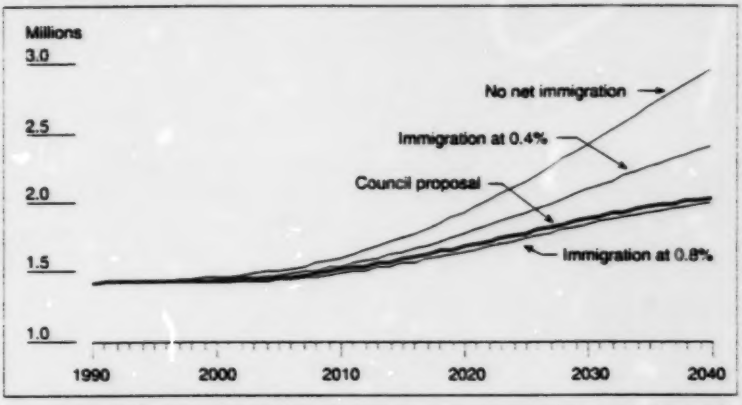
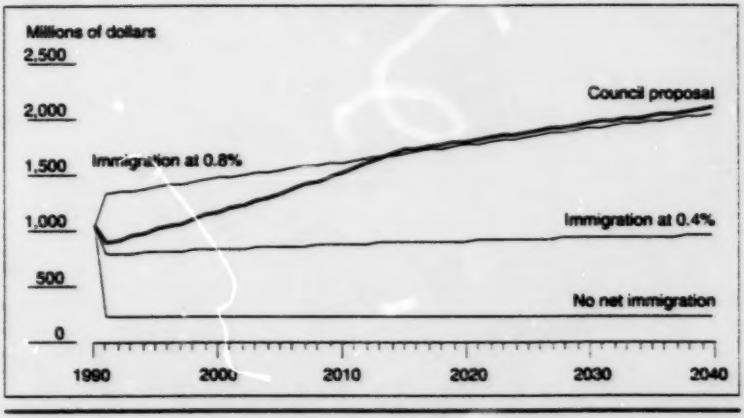



**Figure 8**

**Projected immigration costs, 1990-2040**




administrative and other costs) amounted to $432.8 million in 1985. If we assume that the composition of immigration (by age, sex, and country of origin) stays the same, then projecting immigration costs is straightforward (Figure 8). Note that the no net immigration scenario still incurs costs, as there would still be *gross* immigration, but it would be equal to emigration.

For the other scenarios, these expenditures correspond with immigration levels of 139,000 immigrants (net) in 2040 for the low immigration scenario (0.4 per cent), 352,000 for the high immigration scenario (0.8 per cent), and 361,000 immigrants for the Council proposal.

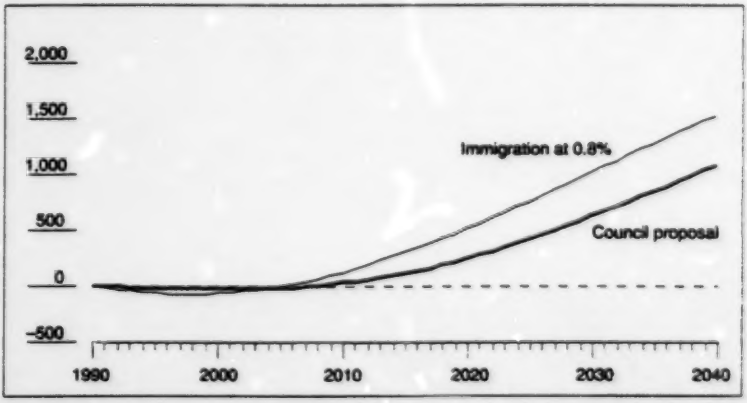
For the 0.8 per cent immigration scenario, the per-capita costs run at about $50 for the whole period (reflecting immigration as a constant proportion of population), which is about $20 more than for the low immigration scenario (0.4 per cent). The Council proposal starts with lower costs but ends up higher, because of its shape.

### *Immigrant gain (IG)*

We can now join all the pieces of the puzzle together. By taking the savings on expenditures, plus any gains on per-capita taxes (both brought about by the changing age structure of the population due to higher immigration), and subtracting the costs incurred by higher immigration, we get a gain series for each year of the projection by comparing any two scenarios. Discounting those future gains and summing them using equation (3), we get the immigrant gain (IG) (Figure 9).

**Figure 9**

**Cumulative discounted per-capita gains from higher immigration compared with the 0.4% immigration scenario, projected, 1990-2040**




We chose the low immigration scenario (0.4 per cent) as the base case, as it corresponds roughly with the average level of immigration for the past five years, and we compared the two high immigration scenarios with the base case. Over the long term, both high immigration scenarios bring non-negligible savings over the base case — $1,500 for the 0.8 per cent scenario and slightly less than $1,100 for the Council's proposal, using a real interest rate of 5 per cent. It takes some time to break even; the high immigration scenario gets into the black in 2006, Council's is in the black by 2008. This is because immigration costs are incurred at the time of arrival, whereas the

benefits are cumulative and take more time to show up. Finally, since the two scenarios are based on different immigration assumptions, their results are slightly different: the Council proposal does not go into the red as much as the 0.8 per cent case does because it assumes lower immigration in the beginning, but it does not bring as many benefits over the long run, for the same reason.

### *Sensitivity of projections to assumptions*

Our projections rely on a certain number of assumptions that we believe to be realistic. What would happen if we changed some of these parameters?

One assumption that some may find objectionable is our choice of discount rate. We chose 5 per cent because it corresponds roughly with the average real interest rate in the 1980s; however, it was much lower in the last 50 years. Therefore, we ran the same scenarios with a discount rate of 2 per cent to determine the difference. While at 5 per cent the 0.8 per cent immigration projection produced a discounted gain of roughly $1,500 over 50 years and the Council's proposal produced a gain of around $1,100, at 2 per cent the figures are $4,500 and $3,400, respectively. This seems much larger; however, one must keep in mind that these figures are *savings* from the 0.4 per cent immigration scenario, and it will still cost more to maintain our social system in its present form.

Another question one might ask is: Could we not get the same results through changes in the fertility rate? In order to answer this question, we ran an extra simulation keeping all the assumptions the same as for the 0.4 per cent immigration projection, except that we raised the fertility rate from 1.67 children per woman to the replacement rate of 2.1, and then compared it with the base 0.4 per cent immigration scenario as before. The result is a population of 39.5 million people in 2040, with a cumulative discounted gain of $775 at a 5 per cent discount rate (or $3,140 at a 2 per cent rate), with no net gains until the year 2025 (2022 in the 2 per cent case). Remember that the figures for the two high immigration scenarios were $1,500 and $1,100 respectively, with a break-even point in the year 2006 or 2008. This means that even if the fertility rate could be brought up to such a high rate, we would still be better off with higher immigration. This is because a higher fertility rate implies education costs for roughly 20 years for every extra child, whereas immigrants come at a later age and the costs of education are avoided.

Finally, the death rate is a relevant assumption — as time goes by, people live longer, which would affect our projections. We did not explore that avenue: however, we can safely predict that a longer life expectancy would lead to higher costs for all the scenarios, and *increased* savings for the high immigration projections compared with the base case. Still, this might not become a problem, as life expectancy increases seem to be levelling in Canada, as they are elsewhere in the industrialized world.

## Conclusion

In this paper we have attempted to measure the impact of immigration on social expenditures. While higher immigration results in a non-negligible benefit, it will still be more costly to maintain the social system in its present state, because real per-capita costs go up in all scenarios by a sizeable amount (at least 24 per cent in our projections). Note that these projections are not forecasts: what they enable us to say is that if the trend continues, this is what will happen.

In theory, it is possible to build an immigration scenario such that the per-capita costs would remain constant, thus mitigating the burden of dependency. Such a scenario would be unrealistic and undesirable however, because of problems administering the flow, and the potential increase in social and ethnic tensions. This was the reasoning behind the Council's proposal, and why it was deemed preferable to the 0.8 per cent immigration scenario.

Our results have also shown that immigration is preferable, in monetary terms, to higher fertility rates, regardless of the discount rate used and the feasibility of increasing fertility.

There are gains to more immigration that will help us relieve the future burden of dependency, but it will not solve all our problems. It is likely that pressure to overhaul the social system will grow in the future.

**A technical appendix containing detailed descriptions of the data, provincial per-capita costs (age and sex distributed), and provincial expenditure projections has been published under separate cover and is available on request from the authors.**

## Notes

1. All figures are in 1985 dollars, unless otherwise specified.

2. The details of our estimation procedure are described in a technical supplement, published under separate cover, which is available upon request.

3. *An Analysis of Hospital Expenditures in Canada*, by D.E. Angus, et al., Statistics Canada, March 1982.

4. Statistics Canada, Residential Care Facilities, Catalogue No. 83-236. Note in the case of Quebec, corporations are listed, not operating facilities.

5. Some facilities may not respond to Statistics Canada questionnaires, so the published estimates are likely to understate the number of residents in these institutions.

6. In Manitoba all institutions respond directly to the survey conducted by Statistics Canada, except the institutions which provide personal care services (i.e., nursing homes). Data for these institutions were provided by the Manitoba Health Services Commission.

7. Statistics Canada, cat. no. 83-236, Table 11.

8. The following sources were used: Nova Scotial Medical Services Insurance, Annual Statistics, 1985–86; Régie de l'Assurance-maladie, Statistiques annuelles, 1985; Saskatchewan Medical Care Insurance Commission, Annual Report, 1985–86; Alberta Health Care Insurance Plan, Annual Report, 1986; British Columbia Ministry of Health, Annual Report, 1986–87.

9. Our estimates are largely based on the following sources. The expenditure data by level of education come from Statistics Canada publication: Financial statistics of education, 1986–86, Catalogue No. 81-208. Similarly, the enrolment data are published by Statistics Canada: Elementary and secondary school enrolment, 1985–86, Catalogue No. 81-210; enrolment in colleges, and in universities: Education in Canada, A statistical review for 1986–87, Catalogue No. 81-229. For demographic statistics we used Statistics Canada census tapes. In Appendix A we describe by way of examples the methodology and procedures used in our calculations of age- and sex-specific expenditure per student for each of the three major levels of education.

10. See Saiyed [1988] for more details.

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